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IS 7693 (2004): Electrical Apparatus for Explosive Gas Atmospheres - Oil-Immersion 'o' [ETD 22: Electrical Apparatus for Explosive Atmosphere]

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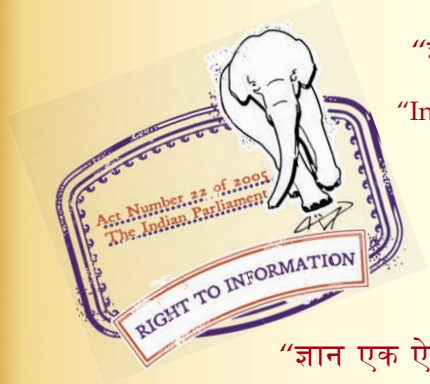

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS 7693 : 2004
IEC 60079-6 (1995)

भारतीय मानक

विस्फोटक गैस वातावरण के लिए विद्युत के उपकरण — तेल निमज्जन "o"

(पहला पुनरीक्षण)

Indian Standard

ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES — OIL-IMMERSION "o"

(First Revision)

ICS 29.260.20

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

April 2004

Price Group 3

NATIONAL FOREWORD

This Indian Standard (First Revision) which is identical with IEC 60079-6 (1995) Electrical apparatus for explosive gas atmospheres — Part 6 : Oil-immersion "o" issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendations of the Electrical Apparatus for Explosive Atmospheres Sectional Committee and approval of the Electrotechnical Division Council.

This standard was first issued in 1975. The first revision of this standard has been undertaken to align it with corresponding IEC Standard.

This standard is not intended to take place of various statutes and regulations in force in the country applicable to the installation. Statutory regulations shall be followed wherever these are more stringent than this standard.

The text of the IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker, while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

Only the English text of the International Standard has been retained while adopting it as an Indian Standard, and as such the page numbers given here are not the same as in IEC Publication.

CROSS REFERENCES

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their place are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 60079-0 (2000) Electrical apparatus for explosive gas atmospheres — Part 0 : General requirements	IS 13346 : 2004 Electrical apparatus for explosive gas atmospheres — General requirements (*first revision*)	Identical
IEC 60079-7 (1990) Electrical apparatus for explosive gas atmospheres — Part 7 : Increased safety "e"	IS 6381 : 2004 Electrical apparatus for explosive gas atmospheres — Increased safety "e" (*first revision*)	do
IEC 60079-11 (1999) Electrical apparatus for explosive gas atmospheres — Part 11 : Intrinsic safety "i"	IS 5780 : 2002 Electrical apparatus for explosive gas atmospheres — Intrinsic safety "i" — Specification (*second revision*)	do
IEC 60079-15 (2001) Electrical apparatus for explosive gas atmospheres — Part 15 : Electrical apparatus with type of protection "n"	IS 8289 : 1976 Electrical apparatus with type of protection "n"	Equivalent

(*Continued on third cover*)

Indian Standard

ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES — OIL-IMMERSION "o"

(First Revision)

1 Scope

1.1 This part of IEC 79 specifies the requirements for the construction and testing of oil-immersed electrical apparatus, oil-immersed parts of electrical apparatus and Ex components in the type of protection "o", intended for use in potentially explosive atmospheres of gas, vapour and mist.

1.2 This standard supplements IEC 79-0, the requirements of which apply to oil-immersed electrical apparatus.

1.3 This standard is applicable to electrical apparatus and parts of electrical apparatus which are not ignition capable in normal operation. Compliance of the electrical apparatus is to be assessed against IEC 79-15 except for those parts designed to comply with IEC 79-11.

NOTE – This standard assumes that the electrical apparatus immersed in the protective liquid is fixed in its operating position in accordance with the installation instructions.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 79. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 79 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

Information about the revision of IEC 79-0 and related standards is given in the foreword of this standard.

IEC 79-0: 1983, *Electrical apparatus for potentially explosive atmospheres – Part 0: General requirements**

IEC 79-7: 1990, *Electrical apparatus for explosive gas atmospheres – Part 7: Increased safety "e"* *

IEC 79-11: 1991, *Electrical apparatus for explosive gas atmospheres – Part 11: Intrinsic safety "i"* *

IEC 79-15: 1987, *Electrical apparatus for explosive gas atmospheres – Part 15: Electrical apparatus with type of protection "n"* *

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* Revised editions of these standards are under consideration.

IEC 156: 1963, *Method for the determination of the electric strength of insulating oils*

IEC 247: 1978, *Measurement of relative permittivity, dielectric dissipation factor and d.c. resistivity of insulating liquids*

IEC 296: 1982, *Specification for unused mineral insulating oils for transformers and switchgear*

IEC 529: 1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 588-2: 1978, *Askarels for transformers and capacitors – Part 2: Test methods*

IEC 836: 1988, *Specifications for silicone liquids for electrical purposes*

ISO 2719: 1988, *Petroleum products and lubricants – Determination of flash point – Pensky-Martens closed cup method*

ISO 3016: 1974, *Petroleum oils – Determination of pour point*

ISO 3104: 1976, *Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity*

3 Definitions

For the purpose of this part of IEC 79, the following definitions apply; they supplement the definitions which are given in IEC 79-0.

3.1 **oil immersion "o":** Type of protection in which the electrical apparatus or parts of the electrical apparatus are immersed in a protective liquid in such a way that an explosive atmosphere which may be above the liquid or outside the enclosure cannot be ignited.

3.2 **protective liquid:** Mineral oil conforming to IEC 296 or an alternative liquid meeting the requirements of 4.1.

3.3 **sealed apparatus:** Apparatus designed and constructed in such a manner as to prevent ingress of an external atmosphere during the expansion and contraction of the internally contained liquid during normal operation, for example, by means of an expansion vessel.

3.4 **non-sealed apparatus:** Apparatus designed and constructed in such a manner as to allow the ingress and egress of an external atmosphere during the expansion and contraction of the internally contained fluid during normal operation.

3.5 **maximum permissible protective liquid level:** Maximum level that the protective liquid can attain in normal service, taking into account the effects of expansion from the worst-case filling condition specified by the manufacturer to the condition of full load at maximum ambient temperature for which the apparatus is designed.

3.6 **minimum permissible protective liquid level:** Minimum level that the protective liquid can attain in normal service taking into account the effects of contraction from the worst-case filling condition to the condition of de-energization at minimum ambient temperature.

4 Constructional requirements

4.1 Protective liquid other than mineral oil conforming to IEC 296 shall comply with the following specific requirements:

a) the protective liquid shall have a fire point of 300 °C (minimum) determined by the test method indicated in IEC 836;

b) the protective liquid shall have a flash-point (closed) of 200 °C (minimum) determined in accordance with ISO 2719;

c) the protective liquid shall have a kinematic viscosity of 100 cSt (maximum) at 25 °C determined in accordance with ISO 3104;

d) the protective liquid shall have an electrical breakdown strength of 27 kV (minimum) determined in accordance with IEC 156.

In the case of silicone liquids IEC 836 shall be used;

e) the protective liquid shall have a volume resistivity at 25 °C of 1×10^{12} Ω·m (minimum) determined in accordance with IEC 247;

f) the pour point shall be –30 °C (maximum) determined in accordance with ISO 3016;

g) the acidity (neutralization value) shall be 0,03 mg KOH/g (maximum) determined in accordance with IEC 588-2;

NOTE – The reference to IEC 588-2 identifies a test method only; it does not allow the use of substances prohibited by legislation.

h) the protective liquid shall have no adverse effect on the properties of materials with which it is in contact.

The manufacturer shall provide data to confirm compliance with the above.

4.2 For group I apparatus, mineral oils are not acceptable.

4.3 The apparatus shall be constructed so that deterioration of the protective liquid by dust or humidity from the exterior is prevented by the following means.

4.3.1 Apparatus which is sealed shall be provided with a pressure-relief device. This device shall be set and sealed by the manufacturer of the liquid-filled apparatus to operate at least at 1,1 times the pressure above the liquid level at the maximum permissible protective liquid level.

4.3.2 Apparatus which is not sealed shall be constructed so that gas or vapour which may evolve from the protective liquid in normal service can readily escape. A breathing device complete with suitable drying agent shall be provided. The manufacturer shall specify the maintenance requirements for the drying agent. The testing station is not required to verify the suitability of the drying agent nor its maintenance.

4.3.3 The apparatus shall have a degree of protection of at least IP66 as given in IEC 529 with no ingress of water.

The outlet of the breathing device for non-sealed apparatus and the outlet of the pressure relief device for sealed apparatus shall have a degree of protection of at least IP23 as given in IEC 529.

4.4 Means shall be provided to guard against accidental loosening of external and internal fasteners, as well as of devices to indicate the liquid level, plugs and other parts for filling or draining the liquid.

Examples of means to guard against accidental loosening are:

- cementing of threads;
- locking washers;
- wiring of bolt heads.

A warning label is not considered sufficient.

4.5 A protective liquid level indicating device(s) complying with the requirements of 4.5.1 to 4.5.3 shall be provided so that the liquid level of each separate liquid-filled compartment can be easily checked in service.

4.5.1 The maximum and the minimum protective liquid levels permissible in normal service shall be clearly marked, taking into account the effects of expansion and contraction resulting from operational temperature changes over the full ambient temperature range specified by the manufacturer.

4.5.2 The protective liquid level indicating device shall be so marked to indicate the levels to which the electrical apparatus shall be filled under the filling temperature conditions specified by the manufacturer. Alternatively, an adjacent label shall be provided which fully specifies the filling conditions.

4.5.3 The construction shall be such that, unless the manufacturer can demonstrate that in normal service leakage from the indicating device will not occur, the minimum possible filling level of the protective liquid cannot fall beneath the level necessary to comply with 4.7, taking into account the effects of expansion and contraction resulting from operational temperature changes over the full ambient temperature range specified by the manufacturer.

4.5.4 The manufacturer shall provide data to show that transparent parts will retain their mechanical and optical properties when in contact with the protective liquid.

4.5.5 For non-sealed apparatus, a dipstick may be used, provided that in normal operation the dipstick is secured in its measurement position and that the requirements of 4.3 with regard to ingress protection are maintained. An adjacent label shall be provided, requiring the dipstick to be replaced after use.

4.6 The lower of the two temperatures specified in 4.6.1 and 4.6.2 shall not be exceeded.

4.6.1 The temperature at the free surface of the protective liquid shall not exceed a value equal to 25 K less than the stated minimum flash-point (closed) for the protective liquid used.

4.6.2 The temperature at the free surface of the protective liquid or at any point on the surface of the electrical apparatus to which a potentially explosive atmosphere has access shall not exceed the limit specified in IEC 79-0, for the specified temperature class.

4.7 With the exception of conductors meeting the clearance and creepage distance requirements of IEC 79-7, or forming part of a circuit complying with the safety requirements of IEC 79-11, live parts of electrical apparatus shall be immersed to a depth of not less than 25 mm below the surface of the protective liquid, at the minimum possible liquid level.

Apparatus, components and conductors not complying with the above requirement shall have a type of protection specified in the scope of IEC 79-0.

4.8 Any possibility of the protective liquid being lost by capillary or siphon action shall be prevented.

4.9 Devices for draining the liquid shall be provided with an effective sealing device and shall be secured by fastener(s) that are shrouded or secured against unauthorized removal.

4.10 Covers of sealed enclosures may be continuously welded to the enclosure, or sealed by means of a gasket in which case the cover shall be provided with fasteners that are shrouded or secured against unauthorized removal.

4.11 Non-sealed enclosures shall be provided with an oil expansion facility and be equipped with a manually only resettable protective device which automatically causes interruption of the supply current if there is an internal fault in the liquid-filled enclosure such as would create evolution of gas from the protective liquid.

5 Verifications and tests

5.1 *Type tests*

5.1.1 *Overpressure test on sealed enclosures*

A pressure equal to 1,5 times the pressure relief device setting shall be applied internally with the enclosure filled with the protective liquid to at least the maximum permissible protective liquid level. The period of application of the pressure shall be at least 60 s. The pressure relief device entry shall be sealed for the duration of the test.

The test shall be considered satisfactory if, at the end of the test, the enclosure has suffered neither damage nor permanent distortion which adversely affects its ability to comply with 4.3.3.

5.1.2 *Reduced pressure test on sealed enclosures*

The internal pressure of the enclosure without protective liquid shall be reduced by an amount equivalent to not less than the change in the protective liquid level from the maximum permissible level to the minimum permissible level when appropriately corrected for any ambient temperature variations.

At the end of 24 h any increase in pressure shall not exceed 5 %.

5.1.3 *Overpressure test on unsealed enclosures*

A pressure equal to 1,5 times atmospheric pressure, with the breather sealed, shall be applied internally with the enclosure filled with liquid to at least maximum protective liquid level. The period of application shall be at least 60 s.

The test shall be considered satisfactory if, at the end of the test, the enclosure has suffered neither damage nor permanent distortion which adversely affects its ability to comply with 4.3.3.

5.2 *Routine tests*

5.2.1 Each sealed enclosure shall be subjected to both the following tests in sequence:

a) *the overpressure test described in 5.1.1.* This routine test may be omitted for welded enclosures, if during type testing, the apparatus complies with the acceptance criteria in 5.1.1 using four times the prescribed pressure (i.e. six times the pressure relief device setting);

b) *the test described in 5.1.2 or an equivalent,* accelerated test using a lower pressure proposed by the manufacturer. In the latter case, the manufacturer shall prove that his test will achieve the same threshold value of leakage as in the 24 h test.

5.2.2 Each unsealed enclosure shall be subjected to the test specified in 5.1.3. This routine test may be omitted for welded enclosures, if during type testing, the apparatus complies with the acceptance criteria in 5.1.3 using four times the prescribed pressure (i.e. 6 bar).

6 Marking

In addition to the marking prescribed in IEC 79-0 the electrical apparatus shall also carry information as follows:

a) the protective liquid to be used;

b) the pressure relief device setting where appropriate.

NOTE – In some countries, further information, giving for instance the net calorific value and fire point of the protective liquid, may be necessary before the equipment can be used.

(*Continued from second cover*)

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 60156 (1963) Method for the determination of the electric strength of insulating oils	IS 6792 : 1992 Method for determination of electric strength of insulating oils	Equivalent
IEC 60247 (1978) measurement of relative permittivity, dielectric dissipation factor and d.c. resistivity of insulating liquids	IS 4486 : 1967 Recommended methods for the determination of the permittivity and dielectric dissipation factor of electrical insulating materials at power frequencies including metre wavelengths	Not equivalent
IEC 60296 (1992) Specification for unused mineral insulating oils for transformers and switchgear	IS 335 : 1993 New insulating oils	Equivalent
IEC 60529 (1989) Degrees of protection provided by enclosures (IP Code)	IS 12063 : 1987 Classification of degrees of protection provided by enclosures of electrical equipment	do
IEC 60588-2 (1989) Askarels for transformers and capacitors — Part 2 : Test methods	IS 13067:1991 Impregnants for power capacitors	do
ISO 2719 : 1988 Petroleum products and lubricants — Determination of flash point — Pensky-Martens closed cup method	IS 1448 [P : 21] : 1992 Petroleum and its products — Methods of test : [P : 21] Flash point (closed) by Pensky-Martens apparatus	do
ISO 3016 : 1974 Petroleum oils — Determination of pour point	IS 1448 [P : 10] : 1970 Methods of test for petroleum and its products: [P : 10] Cloud point and pour point	do
ISO 3104 : 1976 Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity	IS 1448 [P : 25] : 1976 Methods of test for petroleum and its products : [P : 25] Determination of kinematic viscosity and dynamic viscosity	do

The Technical Committee responsible for the preparation of this standard has reviewed the provisions of the following International Standard and decided that it is acceptable for use in conjunction with this standard:

IEC 60836 (1988) Specifications for silicone liquids for electrical purposes

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Bureau of Indian Standards

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc : No. ET 22 (5420).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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AMENDMENT NO. 1 DECEMBER 2006
TO
IS 7693 : 2004/IEC 60079-6 (1995) ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES — OIL-IMMERSION "o"

(First Revision)

(*Second cover, National Foreword, third para*) — Add the following at the end:

'IS 7693 : 1975 and IS 7693 : 2004 versions shall continue to run concurrently till 31 December 2007 after which IS 7693 : 1975 shall be deemed to be withdrawn.'

(ET 22)

Reprography Unit, BIS, New Delhi, India